IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Alan D. Cetel
Serial No.:	10/023,565
Filed:	December 18, 2001
Group Art Unit:	1793
Examiner:	Sheehan, John P.
Title:	High Strength, Hot Corrosion and Oxidation Resistant, Directionally Solidified Nickel Base Superalloy and Articles

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL APPEAL BRIEF

In response to the Notice of Non-Compliant Appeal Brief dated September 2, 2010, Appellant submits this Supplemental Appeal Brief. All appeal fees have been paid. Please charge $490 for a two-month extension of time fee to Deposit Account No. 21-0279 in the name of United Technologies Corporation. If any additional fees are necessary, you are hereby authorized to charge the same Deposit Account or credit the account for any overpayment.

Real Party in Interest

The real party in interest is United Technologies Corporation, assignee of the present application.

Related Appeals and Interferences

A Notice of Appeal was filed on March 22, 2005; Appeal Brief on July 20, 2005; Order Returning Undocketed Appeal to Examiner dated November 29, 2006;

Supplemental Appeal Brief dated July 24, 2007; Examiner's Answer dated October 26, 2007; and Decision on Appeal dated July 21, 2008.

Status of Claims

Claim 4 was previously cancelled. Claims 15-19 were withdrawn from consideration. Claims 1-3 and 5-14 stand rejected and are appealed.

Status of Amendments

All amendments have been entered.

Summary of Claimed Subject Matter

The present application generally relates to nickel based superalloys and articles having high strength and corrosion resistance. The application includes two independent claims (claims 1 and 12), which are summarized as follows.

Independent claim 1 recites a directionally solidified article having more than one crystal and comprising a high strength, corrosion and oxidation resistant nickel base superalloy. The superalloy includes a matrix and from about 0.4 – 1.5 vol. % of a phase based on tantalum carbide (see p.5, paragraph 26). The alloy consists essentially of 10 – 13.5 wt.% chromium, 8 -10 wt.% cobalt, 1.25 – 2.5 wt.% molybdenum, 3.25 – 4.25 wt.% tungsten, 4.5 – 6 wt.% tantalum, 3.25 – 4.5 wt.% aluminum, 3 - 4.75 wt.% titanium, 0.0025 – 0.025 wt.% boron, up to about 0.05 wt.% zirconium, 0.05 – 0.15 wt.% carbon, and having no intentional addition of niobium and no intentional addition of hafnium (p.5, paragraph 26). The balance is essentially nickel and the amount of aluminum plus the amount of titanium is between about 6.5 – 8 wt.% (p.5, paragraph 26). The article has at least comparable hot corrosion resistance (measured at 1600°F) (p.6, paragraph 29) and at least twice the oxidation resistance (measured at 2000°F) (p.7, paragraph 30) when compared with a directionally solidified having a nominal composition of 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C, and a balance of nickel, and without application of a solution heat treatment (p.4, paragraph 25).

Independent claim 12 recites a high strength corrosion resistant nickel base superalloy that is adapted for use in columnar grain directionally solidified articles. The

alloy includes about 12 wt.% chromium, 9 wt.% cobalt, 1.9 wt.% molybdenum, 3.8 wt.% tungsten, 5 wt.% tantalum, 3.6 wt.% aluminum, 4.1 wt.% titanium, 0.015 wt.% boron, 0.1 wt.% carbon, and no intentional addition (and in any event less than about 0.02 wt.%) zirconium (p.5, paragraph 26). There is no intentional amount of niobium and the balance is essentially nickel and incidental impurities, wherein the amount of aluminum plus the amount of titanium is about 7.7 wt.% (p.5, paragraph 26). There is additionally a matrix containing about 0.4 – 1.5 vol. percent of a phase based on tantalum carbide (p.5, paragraph 26). The article is also characterized by oxidation resistance at 2000°F of roughly 2.5X (p.7, paragraph 30) and the creep rupture life at 1400°F of roughly 2.4X (p.7, paragraph 31) compared to a similar article having a nominal composition of 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C, and the balance of nickel, and without application of a solution heat treatment (p.4, paragraph 25).

Grounds of Rejection to be Reviewed on Appeal

I. Whether claims 1-3 and 5-14 are properly rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

II. Whether claims 1-3 and 5-14 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over WO99/67435 to Esser et al. (hereafter "Esser").

III. Whether claims 1-3 and 5-14 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over EPO Document No. 0855449A1 to Mitsuhashi et al. (hereafter "Mitsuhashi").

Arguments

I. *Rejection of Claims 1-3 and 5-14 under §112, First Paragraph*

The Examiner argues that the specification of the present application allegedly fails to comply with the written description requirement because the claims contain subject matter which is not described in the specification in a way as to reasonably convey to one skilled in the art that the inventor(s) of the present application had possession of the claimed invention. However, contrary to the Examiner's assertion, the

present application (see paragraphs 9, 14 and 18) supports the claimed feature of not utilizing a solution heat treatment. The application unequivocally states that one goal is to provide an article or alloy that has adequate creep strength without the use of solution heat treating. Thus, one ordinary skill in the art would recognize from the specification that the claimed properties could be achieved without the use of solution heat treating. For this reason, the rejection is improper and must be withdrawn.

II. *Rejection of Claims 1-3 and 5-14 as Obvious over Esser*

The Examiner argues with regard to the claimed feature "without application of a solution heat treatement," that this feature is in effect a process limitation that one of ordinary skill in the art would have considered to have been obvious because this step does not lend patentability to the claimed product. However, even if the solution heat treating is considered to be a process step, the Examiner's conclusion improperly ignores the implication that the heat treatment history of the article or alloy, or lack of heat treating history, affects the microstructure of the article/alloy with regard to properties and size, shape, or presence of microstructural features. The feature "without application of a solution heat treatement" therefore cannot be ignored and must be given due weight in the examination. In this regard, the claimed alloy and article of claims 1 and 12 provides good properties, including creep properties, without subjecting the alloy or part to a solution heat treatment step. In comparison, the article of the Esser reference is subjected to a solution heat treatment at 2300°F and would result in parts having unacceptable creep and other properties.

Additionally, the Examiner contends that Esser's article prior to the heat treatment, is in the non-heated treated state and thereby meets the present claims. However, the unfinished workpiece, prior to heat treating, in the Esser reference cannot be considered to be the claimed article. In Esser, the castings are heat treated at a temperature of 2300°F (page 8, line 5). Such a heat treatment is apparently required in Esser to obtain the properties disclosed therein, such as stress rupture. Thus, one of ordinary skill in the art would not consider the unfinished workpiece to be an article that has suitable oxidation and corrosion resistance for use in a turbine engine, for example. The Esser reference requires the heat treatment to obtain the desired stress rupture and

other properties and thereby teaches against not using solution heat treating because doing so would preclude obtaining the properties desired in Esser.

For the above reasons, the rejection is improper and must be withdrawn.

III. *Rejection of Claims 1-3 and 5-14 as Obvious over Mitsuhashi*

Similar to the rejection based on Esser, the Examiner argues with regard to the claimed feature "without application of a solution heat treatement," that this feature is in effect a process limitation that one of ordinary skill in the art would have considered to have been obvious because this step does not lend patentability to the claimed product. For the same reasons as above under section II of this Brief, the Examiner's conclusion improperly ignores the implication that the heat treatment history of the article or alloy, or lack of heat treating history, affects the microstructure of the article/alloy with regard to properties and size, shape, or presence of microstructural features.

The Examiner also contends that Mitsuhashi's article, prior to the heat treatment, is in the non-heated treated state and thereby meets the present claims. However, as pointed out above under section II, one of ordinary skill in the art would not consider the unfinished workpiece to be an article that has suitable oxidation and corrosion resistance for use in a turbine engine, for example.

For the same reasons as in section II, the rejection is improper and must be withdrawn.

CLOSING

For the reasons set forth above, the final rejection of claims 1-3 and 5-14 is improper and must be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

1. A directionally solidified article having more than one crystal comprising a high strength, corrosion and oxidation resistant nickel base superalloy which comprises a matrix and from about 0.4 to 1.5 vol. % of a phase based on tantalum carbide, the alloy consisting essentially of, in weight percent, of: 10-13.5% chromium; 8-10% cobalt; 1.25-2.5% molybdenum; 3.25-4.25% tungsten; 4.5-6% tantalum; 3.25-4.5% aluminum; 3-4.75% titanium; 0.0025-0.025% boron; up to about 0.05% zirconium; 0.05-0.15% carbon; and having no intentional addition of niobium; no intentional addition of hafnium;

and balance essentially nickel; wherein aluminum + titanium is between about 6.5-8%;

said article having at least comparable hot corrosion resistance (measured at 1600° F.) and at least twice the oxidation resistance (measured at 2000° F) when compared with a directionally solidified having a nominal composition of 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C, and balance Ni, and without application of a solution heat treatement.

2. The article of claim 1, wherein the article comprises a columnar grain, directionally solidified article.

3. The article of claim 2, wherein the article has transverse ductility in excess of 5% at 1400° F and at 1800° F.

5. The article of claim 1 having stress rupture resistance sufficient to ensure that a load of about 27 ksi applied ruptures only after more than 45 hours, and also has a time to 1% creep of more than 15 hours, at 1800° F.

6. The article of claim 5, wherein stress rupture occurs only after more than 85 hours.

7. The article of claim 1, having 11-13% chromium; 8.25-9.75% cobalt; 1.5-2.25% molybdenum; 3.4-4.3% tungsten; 4.7-5.5% tantalum; 3.3-4% aluminum; 3.75-4.3% titanium; 0.008-0.025% boron; up to about 0.04% zirconium; 0.04-0.15 carbon; wherein aluminum + titanium is between about 7-8%.

8. The article of claim 1, having about 12% chromium; 9% cobalt; 1.9% molybdenum; 3.8% tungsten; 5% tantalum; 3.6% aluminum; 4.1% titanium; 0.015% boron; 0.025% zirconium; 0.10% carbon; up to about 0.02 Zr and having no intentional addition of niobium; no intentional addition of hafnium; balance essentially nickel.

9. The article of claim 1, wherein the article comprises a gas turbine engine component.

10. The article of claim 9, comprising a turbine blade or vane.

11. The article of claim 1, further characterized by oxidation resistance at 2000° F of roughly 2.5X, and creep rupture life at 1400° F of roughly 2.4X and at 1800° F of at least roughly 1.5X a similar article having a nominal composition of 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C, and balance Ni.

12. A high strength, corrosion resistant, nickel base superalloy adapted for use in columnar grain directionally solidified articles, comprising in weight percent of about 12% chromium; 9% cobalt; 1.9% molybdenum; 3.8% tungsten; 5% tantalum; 3.6% aluminum; 4.1% titanium; 0.015% boron; 0.1% carbon; and having no intentional addition (and in any event less than about 0.02) zirconium and no intentional amount of niobium; balance essentially nickel and incidental impurities, and wherein aluminum + titanium is about 7.7 %; and including a matrix containing from about 0.4 to 1.5 vol. % of a phase based on tantalum carbide, the article is characterized by oxidation resistance at 2000° F of roughly 2.5X and creep rupture life at 1400° F of roughly 2.4X compared to a similar article having a nominal composition of 14 Cr, 4.9 Ti, 1.5 Mo, 3.8 W, 2.8 Ta, 3 Al, 9.5 Co, 0.01 B, 0.02 Zr, 0.1 C, and balance Ni, and without application of a solution heat treatment.

13. The alloy of claim 9, comprising a gas turbine engine component.

14. The article of claim 13, comprising a turbine blade or vane.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

Decision on Appeal dated July 21, 2008 (copy attached).